Worldwide Ocean Temperature

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2017/11/4

Code Part

```
#!/usr/bin/env Rscript
require(maps)
```

```
## Loading required package: maps
```

```
require(mapdata)
```

```
## Loading required package: mapdata
```

```
library(ggplot2)
library(ggrepel)
args = commandArgs(trailingOnly=TRUE)

dir.create("Cleaned_Data")
```

```
## Warning in dir.create("Cleaned_Data"): 'Cleaned_Data' already exists
```

```
dir.create("Maps")
```

```
## Warning in dir.create("Maps"): 'Maps' already exists
```

```
if (length(args) >= 4) {
  START = as.numeric(args[1])
  END = as.numeric(args[2])
  SAVE_PATH = args[3]
  SAVE_DIR = args[4]
} else {
  SAVE_PATH = "./"                # path for saving and opening data files
  SAVE_DIR = "cleaned_data"   # name of directory to save the clean data
}

# info to save the clean data
FILENAME = "df"
SAVE_EXT = ".Rdata"

# info to construct the filenames
MONTHS = c("jan", "feb", "mar",
           "apr", "may", "jun",
           "jul", "aug", "sep",
           "oct", "nov", "dec")
EXT = ".txt"
DATA_PATH = './data/'

# cleans the data for a specific year == YEAR
cleanAllMonthsOfYear <- function(YEAR) {
  # start constructing the file path
```

```
FILES_PATH = paste(DATA_PATH, YEAR, "/VOSClim_GTS_", sep ='')

# data fram variable of YEAR
df.year <- NULL
EDA.year = NULL
# for every month
for (i in 1:length(MONTHS)) {
  # construct the filename
  filename <- paste(FILES_PATH, MONTHS[i], "_", YEAR, EXT, sep = "")

  # read the file
  print(filename)
  current <- readLines(filename)

  # temporary dataframe for current month months[i]
  df <- NULL
  EDA.Month = NULL
  total_sea_temp = 0
  total_air_temp = 0
  total_rows = 0
  # for every row in the file
  for (j in 1:length(current)) {
    # get the row, and deparate the columns
    tmp <- current[j]
    subtmp <- paste0("SubWest10", "Ship", "tm", substr(tmp, 1, 21), substr(tmp, 86, 89), substr(tmp,

    # isolate the Latitude and Longitude values to check if there are in our sub-region ranges
    # since as.numeric() gives warnings if it finds NA, we need to temporarily suprress warnings
    # source: https://stackoverflow.com/questions/16194212/how-to-suppress-warnings-globally-in-an-r-
    oldw <- getOption("warn")
    options(warn = -1)
    LAT = as.numeric(substr(tmp, 13, 17))   # slices the row and converts to a number
    LON = as.numeric(substr(tmp, 18, 21))
    HOUR = as.numeric(substr(tmp, 9, 12))
    temp_air = as.numeric(substr(tmp, 70, 73))
    temp_sea = as.numeric(substr(tmp, 86, 89))
    options(warn = oldw)

    # checks if LAT and LON are in the range
    # also checks if time when data is collected (hour) is within 6 hours of noon
    # FIX: --> error in feb 2010 w/ && (HOUR %in% 600:1800)
    if ((LAT %in% 600:2000) && (LON %in% 60:80)) {
      # add to the temporary data frame
        if (HOUR == 1200) {
          substr(subtmp, 14, 15) <- "+0"
          df <- rbind(df, subtmp)
        }
        else if ((HOUR %in% 600:1199)) {
          substr(subtmp, 14, 15) <- paste0("-", toString(1200-HOUR))
          df <- rbind(df, subtmp)
        }
       else if ((HOUR %in% 1201:1800)) {
        substr(subtmp, 14, 15) <- paste0("+", toString(HOUR-1200))
```

```
        df <- rbind(df, subtmp)
       }
        else {
          substr(subtmp, 14, 15) <- "A "
          df <- rbind(df, subtmp)
        }

  total_air_temp = sum(total_air_temp, temp_air, na.rm = TRUE)
      total_sea_temp = sum(total_sea_temp, temp_sea, na.rm = TRUE)
      total_rows = total_rows + 1
    }
  }

  # averege tem of each month
  total_rows = total_rows*10
  AVE.AIR.TEMP = total_air_temp/total_rows
  AVE.SEA.TEMP = total_sea_temp/total_rows
  EDA.MONTH = cbind(MONTHS[i], AVE.SEA.TEMP, AVE.AIR.TEMP)
  EDA.year = rbind(EDA.year, EDA.MONTH)

  # generate the columns with given sizes
  data.clean.month <-
    read.fwf(textConnection(df), widths = c(9, 4, 2, 12, 5, 4, 4, 4))

  # name the columns
  names(data.clean.month) <-
    c("REGION","TYP","DIFF", "LOCALTIME", "LAT", "LON", "SST", "AT")

  # omit all rows with "NA" values in any column
  data.clean.month <- na.omit(data.clean.month)

  #(Formatting) Fix Range of lat and AT and SST
  if (nrow(data.clean.month) >= 1) {
    for(i in 1:nrow(data.clean.month)){
      data.clean.month$AT[i] <- toString(as.numeric(data.clean.month$AT[i])/10)
      data.clean.month$SST[i] <- toString(as.numeric(data.clean.month$SST[i])/10)
      data.clean.month$LAT[i] <- toString(floor(as.numeric(data.clean.month$LAT[i])/100))
    }
  }

  # add all the temporary data frame of the month to the data frame of the year
  df.year <- rbind(df.year, data.clean.month)

}

#removing the quantile in AT
#removing the quantile in SST
df.year.with.extremes = df.year

A = quantile(as.numeric(df.year$SST), prob = c(0.99))
B = quantile(as.numeric(df.year$SST), prob = c(0.01))
x = quantile(as.numeric(df.year$AT), prob = c(0.99))
y = quantile(as.numeric(df.year$AT), prob = c(0.01))
```

```
  df.year = df.year[df.year$AT < x,]
  df.year = df.year[df.year$AT > y,]
  df.year = df.year[df.year$SST < A,]
  df.year = df.year[df.year$SST > B,]

  #global map
  global <- map_data("world")
  ggplot() + geom_polygon(data = global, aes(x=long, y = lat, group = group)) +
    coord_fixed(1.3)

  #add borders
  ggplot() +
    geom_polygon(data = global, aes(x=long, y = lat, group = group), fill = NA, color = "blue") +
    coord_fixed(1.3)

  #fill in
  gg1 <- ggplot() +
    geom_polygon(data = global, aes(x=long, y = lat, group = group), fill = "white", color = "grey") +
    coord_fixed(1.3)
  gg1

  #specific latitude/longitude (of year)
  df2 <- data.frame(
    long = as.numeric(df.year$LON),
    lat = as.numeric(df.year$LAT),
    stringsAsFactors = FALSE
  )

  #xlim and ylim can be manipulated to zoom in or out of the map
  final <-  gg1 +
    geom_point(data=df2, aes(long, lat), colour="blue", size=1) +
    ggtitle(paste("Subcontinent West", YEAR, sep=" ")) +
    theme(plot.title = element_text(hjust = 0.5)) +
    geom_text_repel(data=df2, aes(long, lat, label="")) + xlim(60,110) + ylim(0,40)

  ggsave(paste("map_of_", YEAR, ".png", sep=""),path="./Maps")

  # create the save path for the clean data ans save it
  SAVE_PATH_ALL = paste(SAVE_PATH, SAVE_DIR, "/", FILENAME, "_", YEAR, SAVE_EXT, sep = "")
  print(SAVE_PATH)
  save(df.year, file = SAVE_PATH_ALL)
  final

  names(EDA.year) = c("month","ave.sea.temp","ave.air.temp")
  SAVE_PATH_AVE = paste(SAVE_PATH, SAVE_DIR, "/", "ave_temp", "_", YEAR, SAVE_EXT, sep = "")
  print(SAVE_PATH)
  save(EDA.year, file = SAVE_PATH_AVE)

  SAVE_PATH_EXTEREMES = paste(SAVE_PATH, SAVE_DIR, "/", "data_with_extremes", "_", YEAR, SAVE_EXT, sep =
  print(SAVE_PATH_EXTEREMES)
  save(df.year.with.extremes, file = SAVE_PATH_EXTEREMES)

}
```

```
# cleans all data for years 2001 - 2016
cleanAllData <- function(start, end) {
  for (k in start:end) {
    str_frm = toString(k)          # converts year to a string in preparation to call the function
    cleanAllMonthsOfYear(str_frm)  # calls the function for current year
  }
}

# comment in the line below to clean all data from 2001-2016
cleanAllData(2001, 2016)
```

```
## [1] "./data/2001/VOSClim_GTS_jan_2001.txt"
## [1] "./data/2001/VOSClim_GTS_feb_2001.txt"
## [1] "./data/2001/VOSClim_GTS_mar_2001.txt"
## [1] "./data/2001/VOSClim_GTS_apr_2001.txt"
## [1] "./data/2001/VOSClim_GTS_may_2001.txt"
## [1] "./data/2001/VOSClim_GTS_jun_2001.txt"
## [1] "./data/2001/VOSClim_GTS_jul_2001.txt"
## [1] "./data/2001/VOSClim_GTS_aug_2001.txt"
## [1] "./data/2001/VOSClim_GTS_sep_2001.txt"
## [1] "./data/2001/VOSClim_GTS_oct_2001.txt"
## [1] "./data/2001/VOSClim_GTS_nov_2001.txt"
## [1] "./data/2001/VOSClim_GTS_dec_2001.txt"
```

```
## Saving 6.5 x 4.5 in image
```

```
## [1] "./"
## [1] "./"
## [1] "./cleaned_data/data_with_extremes_2001.Rdata"
## [1] "./data/2002/VOSClim_GTS_jan_2002.txt"
## [1] "./data/2002/VOSClim_GTS_feb_2002.txt"
## [1] "./data/2002/VOSClim_GTS_mar_2002.txt"
## [1] "./data/2002/VOSClim_GTS_apr_2002.txt"
## [1] "./data/2002/VOSClim_GTS_may_2002.txt"
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```

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```
## [1] "./"
## [1] "./"
## [1] "./cleaned_data/data_with_extremes_2002.Rdata"
## [1] "./data/2003/VOSClim_GTS_jan_2003.txt"
## [1] "./data/2003/VOSClim_GTS_feb_2003.txt"
## [1] "./data/2003/VOSClim_GTS_mar_2003.txt"
## [1] "./data/2003/VOSClim_GTS_apr_2003.txt"
## [1] "./data/2003/VOSClim_GTS_may_2003.txt"
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## [1] "./data/2003/VOSClim_GTS_jul_2003.txt"
```

```
## [1] "./data/2003/VOSClim_GTS_aug_2003.txt"
## [1] "./data/2003/VOSClim_GTS_sep_2003.txt"
## [1] "./data/2003/VOSClim_GTS_oct_2003.txt"
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## [1] "./cleaned_data/data_with_extremes_2003.Rdata"
## [1] "./data/2004/VOSClim_GTS_jan_2004.txt"
## [1] "./data/2004/VOSClim_GTS_feb_2004.txt"
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## [1] "./data/2006/VOSClim_GTS_nov_2006.txt"
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## [1] "./"
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## [1] "./cleaned_data/data_with_extremes_2014.Rdata"
## [1] "./data/2015/VOSClim_GTS_jan_2015.txt"
## [1] "./data/2015/VOSClim_GTS_feb_2015.txt"
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## [1] "./data/2015/VOSClim_GTS_jul_2015.txt"
## [1] "./data/2015/VOSClim_GTS_aug_2015.txt"
## [1] "./data/2015/VOSClim_GTS_sep_2015.txt"
## [1] "./data/2015/VOSClim_GTS_oct_2015.txt"
## [1] "./data/2015/VOSClim_GTS_nov_2015.txt"
## [1] "./data/2015/VOSClim_GTS_dec_2015.txt"

## Saving 6.5 x 4.5 in image

## [1] "./"
## [1] "./"
## [1] "./cleaned_data/data_with_extremes_2015.Rdata"
## [1] "./data/2016/VOSClim_GTS_jan_2016.txt"
```

```
## [1] "./data/2016/VOSClim_GTS_feb_2016.txt"
## [1] "./data/2016/VOSClim_GTS_mar_2016.txt"
## [1] "./data/2016/VOSClim_GTS_apr_2016.txt"
## [1] "./data/2016/VOSClim_GTS_may_2016.txt"
## [1] "./data/2016/VOSClim_GTS_jun_2016.txt"
## [1] "./data/2016/VOSClim_GTS_jul_2016.txt"
## [1] "./data/2016/VOSClim_GTS_aug_2016.txt"
## [1] "./data/2016/VOSClim_GTS_sep_2016.txt"
## [1] "./data/2016/VOSClim_GTS_oct_2016.txt"
## [1] "./data/2016/VOSClim_GTS_nov_2016.txt"
## [1] "./data/2016/VOSClim_GTS_dec_2016.txt"
```

```
## Saving 6.5 x 4.5 in image
```

```
## [1] "./"
## [1] "./"
## [1] "./cleaned_data/data_with_extremes_2016.Rdata"
```